REMARKS

Claims 1-31 are currently pending in the subject application, and are presently under consideration. Claims 1-7, 12, 15-17, and 20-26 stand rejected. Claims 9-11, 18, and 27-30 are objected to as being dependent from a rejected base claim. Claims 8, 13, 14, 19, and 31 are withdrawn from consideration. Claims 2, 5, 21, 23, and 28 have been amended.

Favorable reconsideration of the application is requested in view of the amendments and comments herein.

I. Objection to the Drawings

The Examiner has objected to FIG. 4 of the drawings under 37 CFR 1.83(a) for failure to show a frequency generator that has a frequency that varies based on an operating voltage. The reference to "[t]he drawing" in 37 CFR 1.83(a) refers to the requirement that the entire set of drawings submitted in the patent application must show every feature claimed. Applicant submits that the claimed features are sufficiently shown in the drawings to satisfy 37 CFR 1.83(a). However, to facilitate prosecution, submitted herewith is an amended set of drawings. Specifically, FIG. 4 has been amended to illustrate the relationship between the supply voltage and the output clock signal CLK_{OUT}. Withdrawal of the objection to FIG. 4 is respectfully requested.

II. Amendment to the Specification

The specification has been amended consistent with the amendment to the FIG. 4. No new matter has been added by this amendment.

III. Claim Objections

Claims 2, 5, and 28 have been objected to for informalities based on a lack of antecedent basis. Accordingly, claims 2, 5, and 28 have been amended to correct the informalities. Specifically, "the first signal" of claim 2 has been amended to recite "the clock signal" introduced in claim 1. Claim 5 has been amended to replace "the reference voltage" with "the operating voltage." Claim 28 has been amended to depend from claim 27, as suggested in the Office Action. Withdrawal of the objections to claims 2, 5, and 28 are respectfully requested.

IV. Rejection of Claims 1-7, 12, 15-17, and 20-25 under 35 U.S.C. 102(b)

Claims 1-7, 12, 15-17, and 20-25 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,416,446 to Holler ("Holler"). Applicant traverses this rejection for at least the following reasons.

The Office Action states that the ring oscillator 102 corresponds to a frequency generator that provides a clock signal. The Office Action, however, contends that the frequency of the output from the ring oscillator 102 is based on an operating voltage V_{DDR}, and that "[t]he voltage V_{DDR} changes with changes in the current supplied [to the ring oscillator] via elements like 204 and because of changes in V_{DD}." Office Action, at lines 13-15. The Office Action further alleges that "[a] change in current through elements like 204 **will cause the V_{DDR} voltage to change** which in turn causes a change in frequency (See column 2, around line 60)." (emphasis added) Office Action, at lines 16-17.

This contention is fundamentally flawed for technical reasons. Firstly, during operation of the ring oscillator, the high and low power rails V_{DDR} and V_{SSR} of the ring oscillator 102 (201, 202, 203) are set to V_{DD} and V_{SS}, respectively, through transistors 222 and 223. For example, due to voltages applied at the gates of the transistors 222 (a PMOS) and 223 (an NMOS) and corresponding voltages at their sources, the respective transistors 222 and 2223 will be operating in the saturation region, such that $V_{DDR} = V_{DD}$ and $V_{SSR} = V_{SS}$ (less corresponding voltage drop across the respective transistors). By operating the transistors 222 and 223 in saturation, the current through the transistors 222 and 223 can maintain a minimum frequency of the ring oscillator when all the controlled transistors 204-221 are turned off. Holler at Col. 2, line 67, through Col. 3, line 2.

Additionally, the voltages V_{DDR} and V_{SSR} will not change in response to changes in current through the ring oscillator 102 (201, 202, 203), as is being suggested in the Office Action. Holler clearly discloses that:

> "The PMOS and NMOS transistor networks limit current to the ring and thereby control the delay through each inverter. This in turn alters the frequency in the following manner: when all the transistors in the binary current tree are on (conducting), the frequency of oscillation of the ring oscillator is maximum. When a given pair of p-channel and n-channel transistors is turned off (non-conducting), the power supply current to the ring is thereby reduced, which reduces the frequency of oscillation." Holler, at Col. 2, lines 58-67.

The Office Action further alleges that "in order for there to be more current through the delay elements, the voltage must increase in value." Office Action, at page 3, lines 17-18. This statement is completely inaccurate and contrary to basic principles of electronics and contrary

to the teachings of Holler. The transistors 204-221 are turned on and off in pairs, one of which sources current and the other of which sinks current relative to the ring oscillator 101 (201, 202, 203). Holler at Col. 3, lines 7-30. Because of such operation, as described above, the voltages V_{DDR} and V_{SSR} will not change in response to changes in current to the ring oscillator by operation of the current tree 101.

The Office Action further contends that Holler teaches a controller (108, 110, 111, and 101) provides a control signal to the current tree. However, in contrast to claim 1, the control signal effects a change in current through components 201, 202 and 203 of the ring oscillator 102. While Holler teaches that the change in current causes a change in the frequency of ring oscillator signal f_{ring}, the control signals to the binary current tree 111 do not adjust any operating voltage based on adjustments to the frequency of the clock signal, as recited in claim 1. As described above, the voltages V_{DDR} and V_{SSR} in the circuit of Holler will not be adjusted based on changes in current through the ring oscillator. Holler simply does not teach that an operating voltage is adjusted based on adjustments to the frequency of a clock signal, as recited in claim 1.

For the reasons stated above, claim 1 and claims depending therefrom (including withdrawn claims) are allowable, and notice of their allowance is respectfully requested.

Regarding claim 3, Holler fails to teach or suggest that the relationship between the clock signal and a second signal having a substantially fixed frequency that defines a maximum frequency for the clock signal, as recited in claim 3. The Office Action supports this position since it fails to cite or reference any teaching in Holler corresponding to the claimed interrelationship. Accordingly, allowance of claim 3 is respectfully requested.

Claim 4 recites a comparator that is operative to ascertain an indication of throttle events that are associated with the frequency generator implementing changes to the frequency of the clock signal. The Office Action contends that the comparator 110 of Holler provides a corresponding indication of throttle events. However, Holler teaches that the comparator 110 inspects the value of a counter to determine whether the frequency of the ring should be changed and in what direction. See bridging paragraph of cols. 3-4. The comparator 110 of Holler provides the comparator output signal to the ring frequency registers for controlling current through the ring oscillator and thereby controlling the frequency of the ring oscillator. In contrast, claim 4 recites that the controller provides the control signal based on the indication of throttle events ascertained by the comparator. As recited in claim 1 and in distinction of Holler, the control signal from the controller is

employed to adjust the operating voltage. For these reasons, Holler does not anticipate claim 4.

Regarding claim 5, Holler discloses that:

> "The frequency controller serves to measures the frequency of the ring oscillator, and send the appropriate control signals to the binary current tree to obtain (or maintain) the desired ring oscillator frequency. To accomplish this, the gated counter 108 counts the number of cycles of the ring oscillator during a known interval, which is a function of the crystal 106 connected to the crystal oscillator 105. The gated counter is pre-loaded with the one's complement of the desired count from the reference frequency register 109. The counter then counts up during the sampling interval. The value of the counter is inspected by the comparator 110 to determine whether the ring frequency should be changed and in what direction (faster or slower). For this purpose, comparator 110 provides "up", "down", and "equal" signal outputs to the ring frequency registers 111." Holler, at bridging paragraph of cols. 3-4.

Holler is silent as to what the comparator is comparing with the count value. From the text of Holler, since the gated counter 108 is initially loaded with a one's complement of a count for a desired frequency, it seems that the count value is being inspected relative to zero or to itself to determine whether and in what direction the ring frequency should be changed. Because the particular relationship and function of the comparator of claim 5 is not disclosed (expressly or inherently), claim 5 is not anticipated by Holler. If the Examiner, endeavors to rely on inherency, Applicant respectfully requests that the Examiner produce extrinsic evidence that clearly shows that missing descriptive matter is necessarily present in the thing described in the reference, as inherency may not be established by mere probabilities or possibilities. Moreover, as described above with respect to claims 1 and 4, the comparator 110 of Holler does not provide a comparator signal that controls adjustments to the operating voltage, as also recited in claim 5. The power supply voltages V_{DDR} and V_{SSR} in the circuit of Holler are adjusted based on controls applied to change current through the ring oscillator 101. Accordingly, reconsideration and allowance of claim 5 are respectfully requested.

Regarding claim 6, the Office Action contends that Holler teaches a programmable threshold. Holler is silent, however, as to whether the comparator 110 compares a count value with any value that might be programmable. Instead, the desired count in the reference frequency register 109 is disclosed as being used to pre-load the counter 108 to set a desired frequency of the ring oscillator. Holler, at Col. 3, lines 62-69. Accordingly, claim 6 is not anticipated by Holler. Claim 20 should be allowed for similar reasons.

Claim 7 recites that the threshold defines operating categories, including a first operating category corresponding to a condition in which the operating voltage is too low and

a second operating category corresponding to a condition in which operating voltage is too high. The Office Action concludes that whether the operating voltage is too low or too high bears some relationship to the reference value that is programmed into the reference frequency register 109. As with respect to claim 1, this conclusion appears to be based on the fundamental misunderstanding that the power supply voltages V_{DDR} and V_{SSR} vary as the current changes through the ring oscillator 102. In fact, the power supply voltages V_{DDR} and V_{SSR} in the circuit of Holler do not change in response to changes in current provided by the current tree 101 (204-221). Accordingly, claim 7 is not anticipated by Holler.

Regarding claim 12, the Office Action asserts that Holler includes a second frequency generator 105 by stating that the number of cycles of the second signal over a set sampling interval determines the maximum amount the counter can be changed over the set sampling interval. Claim 12 recites a second frequency generator that provides a second signal having a substantially fixed frequency corresponding to a desired maximum frequency for the clock signal. Holler teaches that a crystal oscillator creates a known interval of time, or sampling interval, during which the number of cycles of the ring oscillator is counted (Holler, col. 3, ll. 62-66). That is, the oscillator 105 in Holler sets a sampling interval for measuring frequency and does not define a maximum frequency for the ring oscillator. Holler continues by stating that a gated counter is pre-loaded with a one's complement of the desired count from the reference frequency register, and that the counter value increments and is inspected by the comparator 110 to determine whether the ring frequency should be increased or decreased (Holler, col. 3, line 66 through col. 4, line 4). At no point does Holler disclose that the number of cycles of the crystal oscillator 105 over a set sampling interval determines the maximum amount the counter can be changed over the set sampling interval, as suggested in the Office Action. Instead, as stated above, the number of cycles of the ring oscillator over the sampling period is compared with a desired count to determine whether the ring oscillator frequency should be adjusted up or down or not change. Holler, at Col. 4, lines 1-6. Accordingly, Holler does not anticipate claim 12. Withdrawal of the rejection of claim 12 is respectfully requested.

Claim 16 recites means for providing an indication of voltage induced throttle events for an integrated circuit and means for controlling a supply voltage of the integrated circuit based on the indication of throttle events. Contrary to the contention in the Office Action, Holler does not disclose any means for controlling a supply voltage, such as the power supply voltage V_{DDR}, based on an indication of throttle events, as recited in claim 16. As described

above regarding claim 1, the supply voltages V_{DDR} and V_{SSR} remain constant regardless of how the current tree 101 (204-221) is controlled to source and sink current relative to the ring oscillator 102 (201, 202, 203). In Holler, even if the supply voltage V_{DDR} were to change, there is no teaching in Holler as to any structure that would perform the function of controlling V_{DDR} based on an indication of voltage-induced throttle events. This deficiency of Holler is because Holler was not designed with any circuitry for providing an indication of voltage induced throttle events. Therefore, Holler does not anticipate claim 16. Withdrawal of the rejection of claim 16, as well as rejected claims that depend therefrom, is respectfully requested.

Claim 21 has been amended to correct typographical errors. Claim 21 recites that the means for controlling implements control of the supply voltage on a cycle time associated with a power control loop, which is greater than the cycle time associated with the clock signal. In contrast to the contention in the Office Action, Holler does not provide any means that controls the supply voltage. The Office Action, however, recites that the frequency controller (referring to elements 108, 110, 111, and 101) are considered part of a power control loop. This characterization, however, is contrary to Holler since these elements do not cooperate in any way to adjust the supply voltage, as recited in claim 21, but instead adjust the frequency by controlling the amount of current being sourced and sunk to the ring oscillator. Since Holler does not anticipate claim 21, reconsideration and allowance of claim 21 are respectfully requested. Claim 25 should be allowed for similar reasons to those stated with respect to claim 21.

Claim 23 has been amended to correct typographical errors. Claim 23 recites a method that includes adjusting a supply voltage of an integrated circuit based on the determination of whether the operating frequency of the integrated circuit are within expected operating parameters. Holler fails to teach determining whether **adjustments** to an operating frequency of an IC are within expected operating parameters based on adjustments made over a cycle time that includes a plurality of cycles at the operating frequency. Instead, Holler discloses measuring the frequency (not adjustments to the frequency) of the ring oscillator and sending control signals to obtain (or maintain) the desired ring frequency. Holler, at the paragraph bridging Cols. 3 and 4. Moreover, as described above regarding amended claim 1, Holler does not teach controlling a supply voltage of an integrated circuit, and thus does not teach adjusting a supply voltage of an integrated circuit based on the determination of whether adjustments to the operating frequency of the integrated circuit are within expected

operating parameters, as recited in amended claim 23. Therefore, Holler does not anticipate amended claim 23. Withdrawal of the rejection of claim 23, as well as claims 24-26 which depend therefrom, is respectfully requested.

V. Rejection of Claim 26 under 35 U.S.C. 103(a)

Claim 26 stands rejected under 35 U.S.C. §103(a) as being unpatentable in view of Holler. Withdrawal of this rejection is respectfully requested for at least the following reasons.

Claim 26 depends from claim 23. Additionally, claim 26 is not referring to the relationship between measuring the frequency and adjusting frequency of the ring oscillator, as is taught by Holler. In contrast, claim 26 (and claims 23 and 25 from which it depends) refers to the cycle time of clock signal control loop (recited as the first cycle time) and the cycle time of a power control loop. As described with respect to claim 21, Holler fails to teach or suggest any functionality relating to a power control loop, other than that power supply voltages V_{DD} and V_{SS} are provided. Since Holler does not teach or suggest the interrelationship between a clock signal control loop and a power control loop, as recited in claim 26, claim 26 is not obvious in view of Holler. Accordingly, withdrawal of the rejection of claim 26 is respectfully requested.

VI. Allowable Subject Matter

Applicants appreciate the indication of allowable subject matter with respect to claims 9-11, 18, and 27-30. Because claims 9-11 depend from claim 1, claim 18 depends from claim 16, and claims 27-30 depend from claim 23, such claims are also patentable. Accordingly, withdrawal of the objection to claims 9-11, 18, and 27-30 is respectfully requested.

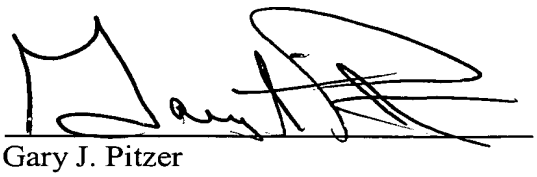
VII. CONCLUSION

In view of the foregoing remarks, Applicant respectfully submits that the present application is in condition for allowance. Applicant respectfully requests reconsideration of this application and that the application be passed to issue. Applicant also notes that since allowable generic claims exist, the withdrawn claims should be reintroduced into the application and be allowed.

Should the Examiner have any questions concerning this paper, the Examiner is invited and encouraged to contact Applicant's undersigned attorney at (216) 621-2234, Ext. 106.

No additional fees should be due for this response. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

Respectfully submitted,

By: 

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